

What is claimed is:

1. A method for optically inspecting a sample, the method comprising:
obtaining empirical optical response information describing the diffraction
resulting from the interaction of a probe beam with the sample;
5 defining a model for the sample, where the model includes one or more control
points, the control points collectively defining the cross-sectional profile of at least one
layer within the sample;

evaluating the model to obtain calculated optical response information predicting
the diffraction resulting from the interaction of the probe beam with the sample; and
10 comparing the empirical optical response information and the calculated optical
response information to determine the accuracy of the model.

2. A method as recited in claim 1 where at least one control point is a
thickness control point and defines a layer thickness within the model.

15 3. A method as recited in claim 1 where at least one control point is a width
control point and at least partially defines the width of the cross-sectional profile.

20 4. A method as recited in claim 1 that further comprises the step of using two
or more control points to define a curve, the curve defining at least part of the cross-
sectional profile.

25 5. A method as described in claim 1 that further comprises:
redefining the model by adjusting one or more control points;
reevaluating the model to minimize the difference between the empirical and
calculated optical response information.

6. A method as described in claim 1 that further comprises:
providing a user with a visual display that includes a representation of the model
as well as the empirical and calculated optical response information;
accepting interactive commands from the user to modify the model;
5 reevaluating the interactively modified model to obtain calculated optical
response information predicting the diffraction resulting from the interaction of the probe
beam with the sample; and
updating the visual display to reflect the calculated optical response information
associated with the modified model.

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7. A method as recited in claim 6 in which the user interactively modifies the
model by changing the position of control points within the model representation.

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8. A method for optically inspecting a sample, where the sample has a
surface that includes a periodically repeating or isolated surface feature, the method
comprising:

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defining a cross-sectional profile for the surface feature, the shape of the cross-
sectional profile defined by a set of two or more control points;

defining the thickness of each layer of materials included in the cross-sectional

profile;

obtaining calculated optical response information predicting the diffraction
resulting from the interaction of the probe beam with the sample by evaluating a model
including the cross-sectional profile and defined thicknesses;

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obtaining empirical optical response information describing the diffraction

resulting from the interaction of a probe beam with the sample; and

comparing the empirical optical response information and the calculated optical
response information to determine the accuracy of the model.

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9. A method as recited in claim 8 where a thickness control points is used to
define a thickness of at least one layer.

10. A method as recited in claim 8 that further comprises the step of defining the thickness of each layer of materials that is not included in the cross-sectional profile.

11. A method as recited in claim 8 where at least one control point is a width 5 control point and at least partially defines the width of the cross-sectional profile.

12. A method as recited in claim 8 that further comprises the step of using two or more control points to define a curve, the curve defining at least part of the cross-sectional profile.

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13. A method as described in claim 8 that further comprises:
redefining the model by adjusting one or more control points;
reevaluating the model to minimize the difference between the empirical and calculated optical response information.

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14. A method as recited in claim 8 where the steps of defining a cross-sectional profile and defining the thickness of each layer of materials included in the cross-sectional profile are performed by moving control points within a graphic representation of the sample.

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15. A method for optically inspecting a sample, where the sample has a surface that includes a periodically repeating or isolated surface; the method comprising:

interactively choosing the location of one or more control points within a graphic representation of the model to define to a cross-sectional profile for the surface feature;

5 interactively choosing the location of one or more control points within a graphic representation of the model to define the thickness of each layer of materials included in the cross-sectional profile;

obtaining calculated optical response information predicting the diffraction resulting from the interaction of the probe beam with the sample by evaluating a model

10 including the cross-sectional profile and defined thicknesses;

obtaining empirical optical response information describing the diffraction resulting from the interaction of a probe beam with the sample; and

comparing the empirical optical response information and the calculated optical response information to determine the accuracy of the model.

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16. An apparatus for optically inspecting a sample, where the sample has a surface that includes a periodically repeating or isolated surface; the apparatus comprising:

a first module configured to allow a user to interactively choose the location of
20 one or more control points within a graphic representation of the model to define to a cross-sectional profile for the surface feature;

a second module configured to evaluate the model to obtain calculated optical response information predicting the diffraction resulting from the interaction of the probe beam with the subject; and

25 a third module configured to visually portray the difference between the calculated optical response information and empirical optical response information obtained for the subject.